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**13. Abstract (Maximum 200 Words)** (abstract should contain no proprietary or confidential information)

We examined the association between dietary patterns and prostate cancer risk using data from the first National Health and Nutrition Examination Epidemiologic Follow-up Study. The study population included 3,779 men followed 1982-4 to 1992, with 136 prostate cancer cases identified during the follow-up. Principal components analysis on responses to a 105-item diet questionnaire in 1982-84 was used to identify dietary patterns, and scores representing level of intake of each pattern were categorized into tertiles. Three distinct patterns were identified: a vegetable-fruit pattern, a red meat-starch pattern characterized by intake of beef, pork, potatoes, and sweets, and a southern pattern characterized by foods including cornbread, grits, bacon, beans, and okra. In proportional hazards models, prostate cancer risk was not associated with the red meat-starch pattern, but it was non-significantly higher with intermediate consumption of a fruit-vegetable pattern and non-significantly lower with high intake of a southern dietary pattern (RR=0.6, 95% CI 0.4-1.1 for highest vs. lowest tertile). Of the nutrients and foods that we examined, only calcium and dairy foods were associated with prostate cancer risk, but RR estimates for dietary patterns were unchanged after adjustment for either calcium or dairy. Features of the patterns that might contribute to the associations that we observed have yet to be elucidated.

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## INTRODUCTION

While epidemiologic studies and intervention trials on diet and prostate cancer have focused primarily on specific factors in the diet, associations of dietary patterns with prostate cancer risk have not been studied previously. Findings based on dietary patterns are valuable for two primary reasons. First, they provide additional insight into the epidemiology of prostate cancer with respect to its distribution within and across populations beyond what can be learned by studying individual dietary components alone. Second, they contribute knowledge needed to evaluate whole-diet modification as an alternative to single-factor dietary strategies towards prevention of the disease. We undertook this research to examine the association between dietary patterns and prostate cancer risk using principal components analysis to measure intake of dietary patterns. Specifically, we sought to (1) confirm the presence of the “western” and “prudent” dietary patterns in a nationally representative sample of men, (2) test the hypothesis that a “western” diet is associated with prostate cancer risk, (3) determine if dietary pattern associations with prostate cancer are stronger than those found for more conventional measures of dietary intake, such as total fat, saturated fat, and red meat intake, and (4) examine the extent to which the difference in prostate cancer risk between black and white men in the US can be attributed to interethnic differences in dietary pattern intake. Below, we describe the progress made over the past year towards the tasks outlined in our Statement of Work.

## BODY

### **Task 1. Acquisition and setup of NHEFS data (months 1-5)**

We were able to obtain relevant subsets of NHEFS data from Dr. Rosalind Breslow (Centers for Disease Control), and from Dr. Regina Ziegler (National Cancer Institute) at no cost. Available datasets were already partially edited and near ready for use in analysis. Descriptive characteristics of the study sample are shown in Table 1.

### **Task 2. Identification of dietary patterns (months 6-12)**

#### **a. Perform principal components analyses to identify dietary patterns**

Patterns of food intake were identified by principal components analysis (PCA) using frequency responses to the NHEFS 1982-84 dietary questionnaire. Individuals were randomly placed into one of two equally sized groups, or split-samples, and the PCA was conducted in the separate samples to confirm reproducibility of patterns identified. Cronbach's coefficient alpha (1) was used to evaluate internal consistency for each component retained; in psychometric research, a coefficient alpha of  $\geq 0.70$  generally indicates acceptable reliability. Three dietary patterns emerged consistently across the split samples (Table 2): (1) a “vegetable-fruit” pattern with high loadings for vegetables, fruits, and seafood (fish and shellfish); (2) a “red meat-starch” pattern with high loadings for red meats, potatoes, salty snacks, cheese, and sweets and desserts; and (3) a “southern” pattern with high loadings for beans, rice, and such traditionally southern foods as cornbread, grits, sweet potatoes, and okra. The same three patterns emerged when we conducted the analysis in black men only.

b. Conduct sensitivity analyses to confirm robustness of results

When we repeated analyses collapsing the 105 food items into 37 predefined food groups (2), only two patterns resembling the vegetable-fruit and red meat-starch patterns emerged. We chose not to collapse food items for two main reasons. First, grouping foods prior to PCA may attenuate measures of association between dietary patterns and disease (3). Second, because different individual food items are consumed in different contexts and in different combinations, creating groups of potentially dissimilar foods may diminish the ability to identify more specific patterns. Additional sensitivity analyses are described under section (d).

c. Assess reliability and validity of dietary patterns identified

As an assessment of construct validity, we described the distributions of selected sociodemographic and health-related characteristics (4-6) across pattern tertiles (Table 3). Men with high intake of the vegetable-fruit pattern were more likely to be white and of higher SES, to live in the northeastern and western US and in suburbs, and to use multivitamins, exercise, and not smoke. Men with high intake of the red meat-starch pattern were more likely to be white and younger in age, to live in rural areas and in the Midwest, and to smoke, exercise, and not use multivitamins. Associations of the red meat-starch pattern with SES indicators reflected neither especially high nor especially low SES: men with high intake were more likely to have graduated high school but not college and were more likely to be above the poverty level but not at the highest incomes. In contrast, men with high intake of the southern pattern were more likely to be black, to be of lower SES, to live in rural areas and in the South, and to smoke and not use multivitamins.

d. Calculate component scores to represent level of intake of each dietary pattern for each subject

A component score was calculated for each dietary pattern for each individual to represent the individual's level of intake for the pattern. The score for each pattern was computed as a linear composite of the foods with meaningful loadings ( $\geq 0.20$ ) for only that pattern. Scores were calculated by taking the unweighted sum of standardized frequencies of intake for each food associated with the pattern. When we computed pattern scores as a linear composite of all variables weighted based on regression results (7), scores calculated the two different ways were highly correlated ( $r > 0.85$ ), and estimates of relative risk for prostate cancer were similar.

**Task 3. Examination of dietary pattern – prostate cancer risk associations (months 13-18)**

a. Conduct statistical analyses to quantify associations between dietary patterns and prostate cancer risk

In Cox proportional hazards models (Table 4), while the red meat-starch pattern was not associated with prostate cancer, intermediate intake of the vegetable-fruit pattern showed a slight elevation of risk (RR=1.5, 95% CI 0.9-

2.3). However, for neither pattern was there evidence of a trend, and none of the point estimates reached statistical significance. Higher intake of the southern pattern showed a trend and a reduction in risk in the third tertile (3<sup>rd</sup> vs. 1<sup>st</sup> tertile RR=0.6, 95% CI 0.4-1.1) that approached statistical significance. In race-specific analyses, associations between dietary patterns and prostate cancer risk were more pronounced in black men and an inverse association for the red meat-starch pattern emerged (Table 5), but estimates were based on a small number of cases, and p-values for interaction were not significant.

Since 1986, when the US Food and Drug Administration approved the prostate-specific antigen (PSA) test for monitoring prostate cancer progression, incidence has increased more steeply in men of higher socioeconomic status and, presumably, with better awareness of or access to screening modalities (8). To explore the possibility of detection bias, we conducted additional analyses including only cases identified before 1986. The inverse association persisted (3<sup>rd</sup> vs. 1<sup>st</sup> tertile RR=0.4, 95% CI 0.2-0.9), but estimates were based on only 46 cases.

b. Perform sensitivity analyses

Risk estimates were not materially different when we excluded 14 prostate cancer cases diagnosed within a year of the dietary interview, re-classified 47 “probable” cases as non-cases, or used age rather than time-on-study as the time scale.

c. Quantify associations between single nutrients/foods and prostate cancer risk for comparison with dietary pattern findings

We explored possible explanations for the inverse association for the southern pattern by examining each of the foods associated with it, but none were associated with prostate cancer risk (Table 6). Intake of other specific nutrients and food groups that have previously been linked to prostate cancer risk were also not clearly associated with disease, although men with an intermediate level of fruit intake had a non-significantly elevated risk.

d. Evaluate dietary patterns as mediator of higher prostate cancer risk in African American vs. white men in NHEFS cohort

Dietary patterns were not pursued as a mediator of the higher prostate cancer risk in African American men because black men remained at higher risk for prostate cancer despite their higher intake of an apparently protective southern pattern.

**Task 4. Final analyses, report writing, and preparation of manuscripts (months 19-24)**

A manuscript describing these results in detail is currently under preparation.

TABLE 1. Descriptive characteristics of study population (N=3,779 men).

Characteristic	
	<i>Mean <math>\pm</math> SD</i>
Age (years)	58.3 $\pm$ 14.7
	<i>N (%)</i>
Race	
White	3,310 (88)
Black	423 (11)
Other	46 (1)
Education	
<HS	1,526 (40)
HS	1,154 (31)
>HS	1,076 (28)
Unknown	23 (1)
Region	
Northeast	1043 (28)
Midwest	1008 (27)
South	797 (21)
West	921 (24)
Unknown	10 (0.3)

Table 2. Factor loadings for foods associated with each dietary pattern, in split samples.

	Vegetable-fruit		Red meat-starch		Southern	
	sample 1 <sup>a</sup>	sample 2 <sup>b</sup>	sample 1	sample 2	sample 1	sample 2
Carrots	55	44		35		
Iceberg/head lettuce	49	47	Salty snacks <sup>c</sup>	47	Cornbread or hush puppies	60
Broccoli	48	49	Fried potatoes	44	Okra	51
Cauliflower	46	47	Pork <sup>d</sup>	42	Sweet potatoes or yellow yams	48
Leaf lettuce	45	38	Mixed dishes with meat or cheese	42	Quickbread <sup>e</sup>	47
Salad dressing	42	40	Pickles or olives	41	Grits	40
Grapefruit	40	32	Chocolate	41	Bacon	40
Cucumber	40	39	Ketchup or tomato chili sauce	37	Beans	36
Green pepper	40	40	Beef	37	Rice	32
Summer squash	38	37	Processed meat <sup>e</sup>	36	Watermelon	35
Pear	37	30	White potatoes	35	Liver	32
Fresh tomato	35	36	Sweets and desserts <sup>f</sup>	34		
Fish (fresh or frozen)	35	33	Cheese sauce, white sauce, thick gravy	34		
Brussels sprouts	35	38	Corn	34		
Apples	35	32	Pasta	30		
Oranges	34	37	Ice cream	27		
Winter squash	34	35	Cheese and cheese dishes	24		
Apricots	33	24	Peanuts	24		
Bananas	32	33				
Vegetable soup	32	25				
Cottage cheese	31	25				
Strawberries	28	26				
Canned fish	26	28				
Cooked tomatoes	25	24				
Plums	24	24				
Shellfish	23	28				
Nuts (not peanuts)	22	21				
Sweet red pepper	22	22				
% variance	5.2	4.5		3.3	2.9	3.4
Coefficient alpha	0.77	0.74		0.64	0.62	0.65

<sup>a</sup> N=1,866 men<sup>b</sup> N=1,913 men<sup>c</sup> Includes potato chips, pretzels, crackers, and salted nuts<sup>d</sup> Includes roast pork, pork chops, fresh ham, and spare ribs<sup>e</sup> Includes sandwich or packaged luncheon meats, hot dogs, and meat spreads<sup>f</sup> Includes cakes, donuts, cookies, pies, and candy<sup>g</sup> Includes muffins, biscuits, and flour tortillas



TABLE 3. Sociodemographic and health behavior characteristics by dietary pattern tertiles (N=3,544).

	Vegetable-fruit pattern tertiles			Red meat-starch pattern tertiles			Southern pattern tertiles		
	1	2	3	1	2	3	1	2	3
Mean age (y)	57 ± 15	57 ± 15	59 ± 14	61 ± 14	58 ± 14	55 ± 14	57 ± 14	57 ± 14	59 ± 15
Black (%)	14	8	9	16	9	7	3	6	24
Region (%)									
Northeast	25	27	33	31	27	26	35	29	19
Midwest	28	29	24	19	28	33	36	30	14
South	26	21	15	24	22	16	7	11	45
West	21	24	28	26	22	25	22	29	22
Residence (%)									
Rural	44	39	34	33	39	44	33	37	48
Urban	37	35	38	42	36	32	38	36	36
Suburbs	19	26	28	25	25	24	30	27	16
Education (%)									
<HS	47	38	34	43	39	36	32	31	57
HS	32	32	29	26	32	35	34	35	24
>HS	21	30	37	31	29	29	34	34	20
Managerial/professional occupation (%)	18	23	28	26	24	19	25	27	16
Poverty-income ratio (%)*									
≤1	15	8	8	14	9	8	6	7	18
>1-3.5	60	60	53	53	57	63	57	57	60
>3.5	23	32	38	33	34	29	37	36	22
Current smoker (%)	36	31	23	27	29	35	28	28	34
Current multivitamin use (%)	20	23	27	26	24	21	25	25	20
Exercise (%)									
Little/none	37	24	26	33	29	27	29	28	31
Moderate	47	56	49	50	52	50	52	51	48
Much	16	20	24	18	19	24	19	20	21

\* Ratio of family income to a Census Bureau-determined poverty threshold for household size and adult/child composition of family; a ratio <1 is considered to represent below poverty level. (N=2,491)

TABLE 4. Relative risk (RR) estimates and 95% confidence intervals (CI) by dietary pattern intake (N=3,616).

Dietary pattern	Prostate cancer cases	Minimal model <sup>a</sup>	Full model <sup>b</sup>
Vegetable-fruit			
tertile 1	35	1.0	1.0
tertile 2	51	1.4 (0.9-1.8)	1.5 (0.9-2.3)
tertile 3	45	1.2 (0.7-1.8)	1.2 (0.7-2.0)
p for trend <sup>c</sup>		0.72	0.64
Red meat-starch			
tertile 1	61	1.0	1.0
tertile 2	38	0.8 (0.5-1.2)	0.7 (0.5-1.2)
tertile 3	32	0.9 (0.6-1.3)	0.8 (0.4-1.4)
p for trend		0.47	0.37
Southern			
tertile 1	45	1.0	1.0
tertile 2	43	0.9 (0.6-1.3)	0.9 (0.6-1.4)
tertile 3	43	0.7 (0.4-1.0)	0.6 (0.4-1.1)
p for trend		0.06	0.08

<sup>a</sup> Models adjusted for age, race, and design variables.

<sup>b</sup> Models adjusted for age, race, design variables, region, urban/rural residence, education, recreational sun exposure, smoking status, leisure physical activity level, energy intake (tertiles), and alcohol intake.

<sup>c</sup> p-value for trend was obtained for each pattern by including in the model a variable representing the median value for each tertile.

TABLE 5. Relative risk (RR) estimates<sup>a</sup> and 95% confidence intervals (CI) for dichotomized pattern intake<sup>b</sup> in black (N=385) and non-black (N=3,231) men.

Dietary pattern	Non-black men		Black men	
	Cases / Non-cases	RR (95% CI)	Cases / Non-cases	RR (95% CI)
Vegetable-fruit				
Low	30 / 1142	1.0	10 / 182	1.0
High	74 / 1985	1.2 (0.8-2.0)	17 / 176	2.0 (0.8-4.9)
p for interaction <sup>c</sup>		0.51		
Red meat-starch				
Low	42 / 930	1.0	17 / 175	1.0
High	62 / 2197	0.8 (0.5-1.4)	10 / 183	0.4 (0.1-1.1)
p for interaction		0.63		
Southern				
Low	93 / 2708	1.0	18 / 174	1.0
High	11 / 419	0.7 (0.3-1.4)	9 / 184	0.2 (0.1-0.6)
p for interaction		0.47		

<sup>a</sup> Models adjusted for age, region, urban/rural residence, education, recreational sun exposure, smoking status, leisure physical activity level, energy intake (tertiles), and alcohol intake.

<sup>b</sup> All pattern scores were dichotomized at median value for black men.

<sup>c</sup> p-value for interaction was obtained by including in the model a dichotomized pattern x race interaction term.

## KEY RESEARCH ACCOMPLISHMENTS

- successfully obtained all necessary and relevant datasets
- successfully conducted planned analyses towards research objectives – namely:
  - in a nationally representative sample of men, confirmed the presence of the two dietary patterns expected *a priori*, and identified a new dietary pattern in the sample
  - examined dietary patterns in relation to prostate cancer risk, finding no association for the red meat-starch pattern as was originally expected, but finding an inverse association for the southern pattern
  - found stronger associations for the southern pattern than for any single food in the southern pattern
  - made a serendipitous finding of higher risk associated with dairy and calcium intake, to be pursued in further analyses

## REPORTABLE OUTCOMES

### *Manuscripts*

Tseng M, Breslow R, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort. *In preparation.*

### *Abstracts*

1. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Proc Am Assoc Cancer Res* 43: 933, 2002.
2. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Am J Epidemiol* 155: S55, 2002.
3. M Tseng, R Breslow, J Babb, RF DeVellis, R Ziegler. Dairy, Calcium, and Prostate Cancer in the NHANES I Epidemiologic Followup Study (abstr). *Am J Epidemiol* 155: S55, 2002.

### *Presentations*

1. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. (2002). Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort. Presented as poster at the American Association for Cancer Research meeting, San Francisco, CA, and at the Society for Epidemiologic Research meeting, Palm Desert, CA.
2. M Tseng, R Breslow, J Babb, RF DeVellis, R Ziegler. (2002). Dairy, Calcium, and Prostate Cancer in the NHANES I Epidemiologic Followup Study. Presented at the Society for Epidemiologic Research meeting, Palm Desert, CA.

## CONCLUSIONS

Our results do not support the hypothesis that a western pattern increases risk of prostate cancer. In contrast, we observed an inverse association for the southern pattern, and RR estimate for the highest tertile and the p for trend approached statistical significance. This finding is especially intriguing because black men were more likely to consume this pattern yet remained at higher risk for prostate cancer. In race-specific analyses, the apparent inverse association

persisted in both black and non-black men. The association was not attributable to any individual foods within the pattern or to any nutrients of prior interest. Our finding raises the possibility that prostate cancer incidence might increase with movement away from a traditional southern cuisine. Alternatively, a southern dietary pattern may serve as an integrative marker of sunlight exposure by reflecting a history of living in the South and, accordingly, of the protective effect of sunlight through the vitamin D production (9). We plan to request approval for conducting additional analyses in our Statement of Work to explore the interaction of the southern pattern with dairy/calcium intake in future work.

In addition, better characterization of the southern pattern than was possible here would offer more information on features of the diet that might be beneficial. Dietary patterns represent only a limited set of foods, and of nutrients for which those foods are major sources. Moreover, using dietary questionnaires created for a purpose other than pattern analysis permits identification of only the most general patterns, even when foods are not grouped. Additional work in developing and improving methods for measuring dietary patterns – for example, using more detailed and focused dietary instruments to identify specific rather than broad dietary patterns, characterizing other dimensions of eating habits such as meal patterns (10, 11) or meal formats (12), and incorporating an understanding of social, economic, and cultural influences on eating habits – could yield important benefits. Measured well, a dietary pattern approach has several potential advantages over a single nutrient or single factor approach: findings are more usefully communicated as public health messages, they provide a better understanding of the extent to which social trends in eating habits affect disease, and they provide a basis for whole-diet interventions to modify risk (13).

In summary, we found that prostate cancer risk was not associated with a red meat-starch pattern, but it was non-significantly higher with intermediate consumption of a fruit-vegetable pattern and non-significantly lower with high intake of a southern dietary pattern. Features of the patterns that might contribute to the associations that we observed have yet to be elucidated. While a pattern approach might yield a valuable perspective in diet-disease studies, strategies for improving methods of identifying and quantifying dietary patterns also require further consideration.

## REFERENCES

1. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951;16:297-334.
2. Hu F, Rimm E, Smith-Warner S, et al. Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. *Am J Clin Nutr* 1999;69:243-249.
3. McCann SE, Marshall JR, Brasure JR, Graham S, Freudenheim JL. Analysis of patterns of food intake in nutritional epidemiology: food classification in principal components analysis and the subsequent impact on estimates for endometrial cancer. *Public Health Nutr* 2001;4:989-997.
4. Levenstein HA. *Revolution at the Table : The Transformation of the American Diet*. New York: Oxford University Press, 1988.
5. McIntosh EN. *American Food Habits in Historical Perspective*. Westport, CT: Praeger Publishers, 1995.
6. Pillsbury R. *No Foreign Food: The American Diet in Time and Place*. Boulder, CO: Westview Press, 1998.

7. Hatcher L. A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling. Cary, NC: SAS Institute, Inc., 1994.
8. Liu L, Cozen W, Bernstein L, Ross RK, Deapen D. Changing relationship between socioeconomic status and prostate cancer incidence. *J Natl Cancer Inst* 2001;98:705-709.
9. Schwartz GG, Hulka BS. Is vitamin D deficiency a risk factor for prostate cancer? *Anticancer Res* 1990;10:1307-1312.
10. Siega-Riz AM, Carson T, Popkin BM. Three square or mostly snacks - What do teens really eat? A sociodemographic study of meal patterns. *J Adol Health* 1998;22:29-36.
11. Goode JG. Cultural patterning and group-shared rules in the study of food intake. In: Peltó GH, Peltó PJ, Messer E, eds. *Research Methods in Nutritional Anthropology*. Tokyo: United Nations University Press, 1989.
12. Jerome NW. Diet and acculturation: the case of Black-American in-migrants. In: Jerome NW, Kandel RF, Peltó GH, eds. *Nutritional Anthropology: Contemporary Approaches to Diet and Culture*. Pleasantville, NY: Redgrave Publishing Co., 1980:275-325.
13. de Lorgeril M, Salen P, Martin J, Monjaud I, Boucher P, Mamelle N. Mediterranean dietary pattern in a randomized trial: Prolonged survival and possible reduced cancer rate. *Arch Intern Med* 1998;158:1181-1187.

## APPENDICES

1. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Proc Am Assoc Cancer Res* 43: 933, 2002.
2. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Am J Epidemiol* 155: S55, 2002.
3. M Tseng, R Breslow, J Babb, RF DeVellis, R Ziegler. Dairy, Calcium, and Prostate Cancer in the NHANES I Epidemiologic Followup Study (abstr). *Am J Epidemiol* 155: S31, 2002.
4. Curriculum vitae

Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Proc Am Assoc Cancer Res* 43: 933, 2002.

Although epidemiologic and laboratory research suggests a role for diet in prostate cancer etiology, the importance of dietary intake overall is difficult to quantify, in part because of previous studies' focus on specific components of the diet. We examined the association between dietary patterns and prostate cancer risk using prospective, nationally representative data from the first National Health and Nutrition Examination Epidemiologic Follow-up Study. The study population included 3,779 men followed 1982-4 to 1992. Prostate cancer cases (n=136) were identified by self-report, hospital records, and death certificates. Principal components analysis on responses to a 105-item food frequency questionnaire in 1982-84 was used to identify patterns of food intake, and component scores representing level of intake of each pattern were categorized into tertiles. Three distinct patterns were identified: a vegetable-fruit pattern, a red meat-starch pattern characterized by intake of beef, pork, potatoes, and sweets, and a Southern pattern characterized by foods including cornbread, grits, bacon, beans, and okra. In Cox proportional hazards models adjusting for age and race, intake of the Southern pattern was inversely associated with prostate cancer (RR=0.6, 95% CI 0.4-0.9 for highest vs. lowest tertile), but no clear associations emerged for other patterns. Preliminary findings suggest that examination of dietary patterns may provide a perspective on diet and prostate cancer that is different from findings based on single dietary factors.

Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort (abstr). *Am J Epidemiol* 155: S55, 2002.

Although epidemiologic and laboratory research suggests a role for diet in prostate cancer etiology, the importance of dietary intake overall is difficult to quantify, partly because of previous studies' focus on specific components of the diet. We examined the association between dietary patterns and prostate cancer risk using prospective, nationally representative data from the first National Health and Nutrition Examination Epidemiologic Follow-up Study. The study population included 3,779 men followed 1982-4 to 1992. Prostate cancer cases (n=136) were identified by self-report, hospital records, and death certificates. Principal components analysis on responses to a 105-item food frequency questionnaire in 1982-84 was used to identify patterns of food intake, and component scores representing level of intake of each pattern were categorized into tertiles. Three distinct patterns were identified: a vegetable-fruit pattern, a red meat-starch pattern characterized by intake of beef, pork, potatoes, and sweets, and a Southern pattern characterized by foods including cornbread, grits, bacon, beans, and okra. In Cox proportional hazards models adjusting for age and race, intake of the Southern pattern was inversely associated with prostate cancer (relative risk (RR)=0.6, 95% confidence interval (CI) 0.4-0.9 for highest vs. lowest tertile), but no clear associations emerged for other patterns. Our findings suggest that examination of dietary patterns may provide a perspective on diet and prostate cancer that is different from findings based on single dietary factors.



M Tseng, R Breslow, J Babb, RF DeVellis, R Ziegler. Dairy, Calcium, and Prostate Cancer in the NHANES I Epidemiologic Followup Study (abstr). *Am J Epidemiol* 155: S31, 2002.

Previous studies indicate that dairy intake increases prostate cancer risk. Whether the association is due to calcium in dairy, however, remains unclear, and findings on calcium intake and prostate cancer are inconsistent. We examined the association of dairy and calcium intake with prostate cancer using prospective data on 3,789 men followed 1982-4 to 1992 as part of the first National Health and Nutrition Examination Epidemiologic Follow-up Study. Prostate cancer cases (n=136) were identified by self-report, hospital records, and death certificates. Calcium, total fat, and energy intake was estimated by multiplying reported frequency of intake of each food in the 1982-4 dietary interview by portion-specific nutrient content estimated from sex- and age-specific 24-hour recall data from the second National Health and Nutrition Examination Survey. Relative risk (RR) of prostate cancer and 95% confidence intervals (95% CI) were estimated using Cox proportional hazards models adjusting for age, race, and energy intake. Compared with men eating dairy products <1 time/day, men eating  $\geq 2$  times/day had a RR of 2.1 (95% CI 1.3-3.5). Lowfat milk in particular was associated with risk (RR 2.0, 95% CI 1.2-3.2 for  $\geq 1$  time/day vs. 3-4 times/week), while whole milk was not (RR 1.1, 95% CI 0.6-2.0,  $\geq 1$  time/day vs. 3-4 times/week). Dietary calcium intake was also associated with risk (RR 2.4, 95% CI 1.5-3.7, 3<sup>rd</sup> vs. 1<sup>st</sup> tertiles), although dietary fat was not (RR 1.0, 95% CI 0.6-1.5, 3<sup>rd</sup> vs. 1<sup>st</sup> tertiles). Our findings support the hypothesis that dairy intake is associated with increased prostate cancer risk, and that the association may be due to its calcium content.

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## **EDUCATION**

- December, 1997    **Ph.D.**, Department of Epidemiology  
School of Public Health, University of North Carolina, Chapel Hill, NC
- April, 1991        **A.M.**, Department of Anthropology  
Stanford University, Stanford, CA
- April, 1991        **B.A.** with Honors, Program in Human Biology  
Stanford University, Stanford, CA

## **RESEARCH EXPERIENCE**

- 2001 – present    **Associate Member**, Fox Chase Cancer Center, Division of Population Science,  
Philadelphia, PA.
- 1998 – 2001       **Assistant Member**, Fox Chase Cancer Center, Division of Population Science,  
Philadelphia, PA.
- 1997 – 1998       **Intramural Research Training Award fellow**, National Institute of Environmental  
Health Sciences, Epidemiology Branch, Research Triangle Park, NC.
- 1996 – 1997       **Project Manager**, Carolina Breast Cancer Study / Family Study Add-on, Department  
of Epidemiology, School of Public Health, the University of North Carolina at Chapel  
Hill, NC.
- 1995 – 1996       **Research Assistant**, Department of Epidemiology, School of Public Health, the  
University of North Carolina at Chapel Hill, NC.
- Jan-Mar 1991     **Research Assistant**, Food Research Institute, Stanford University, Stanford, CA.

## **AWARDS AND HONORS**

- 1998    Delta Omega Public Health Honor Society, University of North Carolina Theta Chapter  
Nominee, Greenberg Dissertation Award, Department of Epidemiology, the University of North  
Carolina at Chapel Hill
- 1997    Winner, Student Poster Competition, American College of Epidemiology meeting  
Epidemiology Student Honoree, School of Public Health Alumni Association, the University of  
North Carolina at Chapel Hill
- 1994    Cancer Prevention and Control and Cancer Epidemiology Research Award, UNC Lineberger  
Comprehensive Cancer Center, the University of North Carolina at Chapel Hill
- 1993    Digestive Disease Epidemiology Training Grant, Division of Digestive Diseases and Nutrition,  
School of Medicine, the University of North Carolina at Chapel Hill  
Merit Assistant Award, Department of Epidemiology, the University of North Carolina at Chapel  
Hill
- 1991    Phi Beta Kappa

## PUBLICATIONS

### Peer-reviewed articles

1. Tseng M, Yeatts K, Millikan R, Newman B. Area-level characteristics and smoking in women. *Am J Public Health* 91: 1847-50, 2001.
2. Tseng M, DeVellis RF. Fundamental dietary patterns and their correlates among US whites. *J Am Diet Assoc* 101: 929-932, 2001.
3. Tseng M, DeVellis RF, Maurer KR, Khare M, Kohlmeier L, Everhart JE, Sandler RS. Patterns of food intake and gallbladder disease in Mexican Americans. *Public Health Nutr* 3: 233-43, 2000.
4. Tseng M, Ingram DD, Darden R, Ziegler RG, Longnecker MP. Eating frequency and risk of colorectal cancer. *Nutr Cancer* 36: 170-76, 2000.
5. Tseng M, Greenberg ER, Sandler RS, Baron JA, Haile RW, Blumberg BS, McGlynn KA. Serum ferritin and recurrence of colorectal adenomas. *Cancer Epidemiol Biomarkers Prev* 9: 625-630, 2000.
6. Tseng M, Millikan R, Maurer KR, Khare M, Everhart JE, Sandler RS. Country of birth and prevalence of gallbladder disease in Mexican Americans. *Ethn Dis* 10: 96-105, 2000.
7. Tseng M, Everhart JE, Sandler RS. Dietary intake and gallbladder disease: a review. *Public Health Nutr* 2: 161-172, 1999.
8. Tseng M, Weinberg CR, Umbach DM, Longnecker MP. Calculation of population attributable risk for alcohol and breast cancer. *Cancer Causes Control* 10: 119-23, 1999.
9. Longnecker MP, Tseng M. Alcohol and hormones in post-menopausal women. *Alc Health Res World* 22: 185-9, 1998.
10. Tseng M, Williams RC, Maurer KR, Schanfield M, Knowler WC, Everhart JE. Genetic admixture and gallbladder disease in Mexican Americans. *Am J Phys Anthropol* 106: 361-71, 1998.
11. Tseng M, Sandler RS, Greenberg ER, Mandel JS, Haile RW, Baron JA. Dietary iron and recurrence of colorectal adenomas. *Cancer Epidemiol Biomarkers Prev* 6: 1029-32, 1997.
12. Tseng M, Chakraborty H, Robinson DT, Mendez M, Kohlmeier L. Adjustment of iron intake for dietary enhancers and inhibitors in population studies: Bioavailable iron in rural- and urban-residing Russian women and children. *J Nutr* 127: 1456-68, 1997.
13. Tseng M, Murray SC, Kupper LL, Sandler RS. Micronutrients and risk of colorectal adenomas. *Am J Epidemiol* 144: 1005-14, 1996.

### Comments, letters, other articles

1. Tseng M. Validation of dietary patterns assessed with a food frequency questionnaire. (Letter). *Am J Clin Nutr* 70: 422, 1999.
2. Tseng M, Morgenstern H. Re: "Eating patterns and risk of colon cancer." (Letter). *Am J Epidemiol* 149: 1074, 1999.
3. Hertz-Picciotto I, Newman B, Vine M, Tseng M, Schroeder J. Re: "Breast cancer and lactation history in Mexican women." (Letter). *Am J Epidemiol* 147: 795, 1998.
4. Tseng M, Yeatts K. "The future of epidemiology:" a panel discussion. *Epidemiology Monitor* 18: 5, 1997.

### **Book chapters**

Longnecker MP, Tseng M. Alcohol and Cancer. In: Nutritional Oncology (Heber D, Blackburn G, eds.). San Diego: Academic Press, Inc., 1998.

### **GRANT APPLICATIONS**

#### **Funded**

1. Dietary patterns and breast density in Chinese American women. Principal investigator (with Drs. Mary B. Daly and W. Thomas London). American Cancer Society, \$333,000, 1/1/01-12/31/03.
2. Dietary patterns and prostate cancer risk in the NHEFS cohort. Principal investigator (with Dr. James S. Babb). US Army, \$91,208, 6/1/01-5/31/03. Fox Chase Cancer Center Institutional Research Grant, \$10,000, 1/1/01-12/31/01.
3. Soy/isoflavone intake, nipple aspirate fluid measures, and urinary estrogen metabolites. Principal investigator (with Dr. Mary B. Daly). Cancer Research Foundation of America, \$70,000, 1/15/01-1/14/03.
4. Estimation of soy and soy isoflavone intake in the diet: A validation study. Principal investigator (with Dr. Mindy S. Kurzer, University of Minnesota, and Dr. Mary B. Daly, Fox Chase Cancer Center). Fox Chase Cancer Center Pilot Project Grant, \$25,000, 8/1/01-12/31/02.
5. Dietary patterns and breast density. Principal investigator (with Dr. Mary B. Daly). American Institute for Cancer Research, \$55,000, 7/1/00-6/30/03.
6. Development and validation of a dietary questionnaire for Chinese American women. Principal investigator (with Drs. Mary B. Daly and W. Thomas London). Fox Chase Cancer Center Institutional Research Grant, \$10,000, 7/1/00-12/31/00.

#### **Pending**

1. Dietary soy/isoflavones and urinary estrogen metabolites. Principal investigator (with Dr. Mindy Kurzer, Dr. Joanne Dorgan, and Dr. Mary B. Daly). National Institutes of Health, \$168,500.
2. Characterizing Dietary Patterns for Measurement in Relation to Breast Cancer. Principal investigator. US Army, \$100,556, 1/1/03-6/30/04.
3. Epidemiology of Soy and Isoflavone Intake in High Risk Women. Principal investigator (with Dr. Mary B. Daly and Dr. Joanne F. Dorgan, Fox Chase Cancer Center). US Army \$622,771, 1/1/03-12/31/06.

### **PRESENTATIONS**

1. Tseng M, Breslow R, Babb J, DeVellis RF, Ziegler R. (2002). Dietary patterns and prostate cancer in the NHANES I Epidemiologic Followup Study Cohort. Presented as poster at the American Association for Cancer Research meeting, San Francisco, CA.
2. Tseng M. (2001). Measurement of environmental exposures. Invited lecture for Clinical Epidemiology course, Thomas Jefferson University, Philadelphia, PA.
3. Tseng M. (2001). Dietary patterns and cancer: using a pattern approach in nutritional epidemiology. Presented at the Center for Clinical Epidemiology and Biostatistics Seminar, University of Pennsylvania, Philadelphia, PA.
4. Tseng M, Malick JD, Daly MB. (2001). Dietary patterns and their correlates in women at high risk for breast or ovarian cancer. Presented as poster at the American Institute for Cancer Research Diet and Cancer Research meeting, Washington, DC.

5. Tseng M, DeVellis RF. (2000). Correlates of the "western" and "prudent" dietary patterns in the US. Presented as poster at the Society for Epidemiologic Research meeting, Seattle, WA, and the Fourth International Conference on Dietary Assessment Methods, Tucson, AZ.
6. Tseng M, Yeatts K, Millikan R. (1999). Multi-level predictors of smoking behavior in women. Presented at the American Public Health Association meeting, Chicago, IL. Presented as poster at the Society for Epidemiologic Research meeting, Baltimore, MD and awarded 2<sup>nd</sup> place for poster session.
7. Tseng M, Evans AA, Ross EA, London WT. (1999). Serum ferritin concentration and hepatitis B e antigen seroconversion. Presented as poster at the American Association for Cancer Research Pathobiology of Cancer Workshop, Keystone, CO.
8. Tseng M, Weinberg CR, Longnecker MP. (1998). Estimation of adjusted population attributable risk (PAR) using effect estimates from meta-analysis. Presented as poster at the Society for Epidemiologic Research meeting, Chicago, IL.
9. Tseng M, DeVellis RF, Maurer KR, Khare M, Kohlmeier L, Everhart JE, Sandler RS. (1997). Patterns of food intake and gallbladder disease in Mexican Americans. Presented as poster at the American College of Epidemiology meeting, Boston, MA.
10. Tseng M, Baron JA, Sandler RS. (1996). Dietary antioxidants and iron and risk of large bowel adenomas. Presented at the Society for Epidemiologic Research meeting, Boston, MA.
11. Tseng M, Sandler RS. (1996). Antioxidants and iron, and risk of colorectal adenomas. Presented at the New Investigators Workshop of the American Society of Preventive Oncology, Bethesda, MD.
12. Tseng M, Murray SC, Kupper LL, and Sandler RS. (1995). Micronutrients and risk of colorectal adenomas. Presented at the Society for Epidemiologic Research meeting, Snowbird, UT.
13. Tseng M. (1995). Iron intake and availability in Russian women. Presented as poster at the Second International Conference on Dietary Assessment Methods, Boston, MA.
14. Tseng M. (1991). Induced physiological tolerance to lactose. Presented at the Human Biology Honors Symposium, Stanford, CA.

## TEACHING / EDUCATIONAL EXPERIENCE

1996 – 1998	<b>Co-organizer</b> , Changing Paradigms in Epidemiology seminar series, Department of Epidemiology, School of Public Health, the University of North Carolina at Chapel Hill, NC.
Aug-Dec 1996	<b>Graduate Assistant</b> , Advanced Methods for Epidemiologic Data Analysis (Epidemiology 269), Department of Epidemiology, School of Public Health, the University of North Carolina at Chapel Hill, NC.
1994 – 1995	<b>Graduate Assistant</b> , Principles of Epidemiology (Epidemiology 160), Department of Epidemiology, School of Public Health, the University of North Carolina at Chapel Hill, NC.
Jun-Aug 1992	<b>Instructor</b> , Biological Sciences, College of Micronesia / United States Peace Corps, Chuuk, Federated States of Micronesia.
1991 – 1993	<b>English instructor / Health educator</b> , Chuuk State Departments of Education and Health Services / United States Peace Corps, Chuuk, Federated States of Micronesia.
Sep-Dec 1990	<b>Teaching Assistant</b> , Human Nutrition, Program in Human Biology, Stanford University.

## PROFESSIONAL ACTIVITIES

**Memberships**    Society for Epidemiologic Research  
                      American Association for Cancer Research  
                      American Society of Preventive Oncology

**Peer reviewer**    *American Journal of Epidemiology*  
                      *American Journal of Public Health*  
                      *Annals of Epidemiology*  
                      *Cancer Research*  
                      *Journal of Epidemiology and Community Health*  
                      *Public Health Nutrition*  
                      *Social Science and Medicine*

### Service

2001-present    Faculty partner, Fox Chase Cancer Center Partnership for Cancer Research Education,  
                      Fox Chase Cancer Center and Carver High School of Engineering and Science

2000-present    Member, American Society for Preventive Oncology Junior Members Sunday Program  
                      Planning Committee

1996-97        Member, Department of Epidemiology Graduate Studies Committee, University of  
                      North Carolina at Chapel Hill